$$\frac{1}{1+e^{-z}} = f(z)$$

$$f'(z) = \frac{-1}{(1+e^{-z})^2} \cdot e^{-z} \cdot (-1)$$

$$= f(z)$$

$$\boxed{= \frac{e^{-z}}{(1+e^{-z})^2}} = \left(\frac{1}{1+e^{-z}}\right)\left(1 - \frac{1}{1+e^{-z}}\right)$$

$$= f(z)\,(1 - f(z))$$

RMS prob

$$W_{n+1} = W_n - \frac{\boxed{\gamma}\, \nabla_w L}{|C_{n+1}|}$$

$\boxed{\text{adam}}$

$$\boxed{C_{n+1} = \rho(C_n) + (1-\rho)\, \nabla_w L}$$

momentum.

$$W_{n+1} = W_n - \gamma V_{n+1}$$

$$\boxed{V_{n+1}} = \rho V_n + \nabla_w L \qquad \rho = 0.9$$

$$y_1 = \underbrace{W_1}\,^T \underbrace{X} + \underbrace{b_1}$$

$$y_2 = W_2^T \underbrace{y_1}_{m} + b_2$$

n

$$y_n = W_n^T y_{n-1} + b_{n-1}$$

$$y = w^T x + b = \sum_{i=0}^{n} w_i x_i + b$$

$$\mathrm{Var}(y) - ?$$

$$\mathrm{Var}(y) = \mathbb{E}(w x)^2 - (\mathbb{E} w x)^2$$

$$= \mathbb{E}(w)^2 \, \mathbb{E} x^2 - (\mathbb{E} w \mathbb{E} x)^2$$

$$= (\mathbb{E} w^2 - (\mathbb{E} w)^2 + (\mathbb{E} w)^2)(\mathbb{E} x^2 - (\mathbb{E} x)^2 + (\mathbb{E} x)^2) - (\mathbb{E} w \mathbb{E} x)^2 =$$

$$= (\mathrm{Var}\, w + (\mathbb{E} w)^2)(\mathrm{Var}\, x + (\mathbb{E} x)^2) - (\mathbb{E} w \mathbb{E} x)^2$$

$$= \cancel{Var\, w\, Var\, x + Var\, x (\mathbb{E} w)^2} +$$

$$\cancel{+ Var\, w (\mathbb{E} x)^2} + \cancel{\mathbb{E} x^2 \mathbb{E} w^2} -$$

$$- \cancel{\mathbb{E} x^2 \mathbb{E} w^2}$$

$$\boxed{w \sim \mathbb{N}(0, 1).}$$

$$Var(y_i) = \underline{Var(w) \cdot Var(x)}.$$

$$Var(y) = \sum_{i=0}^{k} Var(y_i) = k\, Var(y_i) =$$

$$= \boxed{k\, Var(w)}\, \underline{Var(x)}.$$

$$\boxed{w \sim U\left[-\frac{1}{\sqrt{k}} ; +\frac{1}{\sqrt{k}}\right]}$$

$$Var(w) = \frac{1}{12} \left(\frac{2}{\sqrt{k}}\right)^2 = \frac{1}{3k}$$

$$\mathrm{Var}(y) = k \cdot \frac{1}{3 \cdot k} \cdot \mathrm{Var}(x) =$$

$$= \frac{1}{3}\mathrm{Var}(x).$$

$$\mathrm{Var}(\hat{y}) = \left(\frac{1}{3}\right)^{100} \cdot \mathrm{Var}(x) \approx 0$$

$$\mathrm{Var}(w) = \boxed{\frac{2}{k+m}}$$

$$\boxed{W \sim U\left[-\frac{\sqrt{6}}{\sqrt{k+m}}, \frac{\sqrt{6}}{\sqrt{k+m}}\right]}$$

Glorot Uniform

He.

$$\boxed{W \sim N\left(0, \sqrt{\frac{2}{m}}\right)}$$